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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/525,176	03/14/2000	Savvas Vasileiadis		7655

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Savvas Vasileiadis
Zivatech
15549 Dearborn Street
North Hills, CA 91343-3267

EXAMINER

VANOY, TIMOTHY C

ART UNIT	PAPER NUMBER
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1754

DATE MAILED: 01/29/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09-525,176

Applicant(s)

VASILEADIS et al.

Examiner

VANDY

Group Art Unit

1754

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE THREE MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

THE TIME LIMIT FOR CORRECTING THE I.D.S. IS SET TO EXPIRE ONE MONTH FROM THE MAIL DATE OF THIS OFFICE ACTION

Status

☒ Responsive to communication(s) filed on dated Dec. 30, 2001

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 1 - 45 is/are pending in the application.

Of the above claim(s) 1, 2, 5, 6, 9 AND 10 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 3, 4, 7, 8 AND 11-45 is/are rejected.

☒ Claim(s) 3, 4, 7, 8 AND 11-45 is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☒ The specification is objected to by the Examiner.

☒ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____

☐ Copies of the certified copies of the priority documents have been received

in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☒ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

DETAILED ACTION

Election/Restrictions

The Applicants' election without traverse of claims 3, 4, 7, 8 and 11-45 (group II) in the "Response to Office Action 08/21/2001" dated Sept. 18, 2001 is acknowledged.

Information Disclosure Statement

The information disclosure statement date stamped 03/14/00 does not fully comply with the requirements of 37 CFR 1.98 because the reference titled "Environmentally benign hydrocarbon processing . . ." published in Reaction Engineering for Pollution Prevention has not been supplied. Since the submission appears to be *bona fide*, the Applicants are given **ONE (1) MONTH** from the date of this notice to supply the above mentioned omissions or corrections in the information disclosure statement. NO EXTENSION OF THIS TIME LIMIT MAY BE GRANTED UNDER EITHER 37 CFR 1.136(a) OR (b). Failure to timely comply with this notice will result in the above mentioned information disclosure statement being placed in the application file with the noncomplying information **not** being considered. See 37 CFR 1.97(i).

Response to Applicants' "Response to Office Action 11/08/2001"

The Applicants' substitute specification submitted their "Response to Office Action 11/08/2001" has not been entered because it is replete with new matter. *For example*, the substitute specification provides additional reference citations on pgs. 3

and 4 not previously provided in the original specification; the substitute specification on pg. 5 sets forth that the invention relates to double wall type permeable reactors, for methane oxidation, which was not previously provided for in the specification as originally filed; the substitute specification deleted reference to this application as a continuation-in-part of 08/595,040 on pg. 5; the Applicants' substitute specification also provides new examples not originally present in the originally filed specification (please see the Applicants' comments set forth on pg. 2 in their "Response to Office Action 11/08/2001"), etc.

Therefore, the basis of the examination will be on the specification as originally filed. All claim numbers; specification page numbers and figure numbers mentioned in this Office Action refer to the claim numbers; specification numbers and figure numbers in the specification as originally filed.

The requirement for the submission of a substitute specification presented in the Office Communication mailed 11/08/01 is maintained.

Oath/Declaration

The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:
It does not state that the person making the oath or declaration believes the named inventor or inventors to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

It does not state whether the inventor is a sole or joint inventor of the invention claimed.

The specification to which the oath or declaration is directed has not been adequately identified. See MPEP § 601.01(a).

It does not state that the person making the oath or declaration has reviewed and understands the contents of the specification, including the claims, as amended by any amendment specifically referred to in the oath or declaration.

It does not state that the person making the oath or declaration acknowledges the duty to disclose to the Office all information known to the person to be material to patentability as defined in 37 CFR 1.56.

It does not state that the person making the oath or declaration in a continuation-in-part application filed under the conditions specified in 35 U.S.C. 120 which discloses and claims subject matter in addition to that disclosed in the prior copending application, acknowledges the duty to disclose to the Office all information known to the person to be material to patentability as defined in 37 CFR 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Note that pg. 2 in the specification as originally filed sets forth that this application is a continuation-in-part of 08/595,040.

It does not identify the foreign application for patent or inventor's certificate on which priority is claimed pursuant to 37 CFR 1.55, and any foreign application having a filing date before that of the application on which priority is claimed, by specifying the application number, country, day, month and year of its filing.

The clause regarding "willful false statements ..." required by 37 CFR 1.68 has been omitted.

A new oath or declaration is required. The wording of an oath or declaration cannot be amended. If the wording is not correct or if all of the required affirmations have not been made or if it has not been properly subscribed to, a new oath or declaration is required. The new oath or declaration must properly identify the application of which it is to form a part, preferably by application number and filing date in the body of the oath or declaration. See MPEP §§ 602.01 and 602.02.

Specification

- a) The specification is objected to because the lines of the text are not double spaced: please note 37 CFR 1.52(2).
- b) On pgs. 1 and 2 in the specification, the "References cited" (to include all the references) should be deleted. The listing of references in the specification is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609 A(1) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the Examiner on form PTO-892 or by the Applicants on form PTO-1449, they have not been considered.
- c) The cross reference to the related application 08-595,040 set forth on pg. 2 should be set forth immediately below the title in a separate section titled: "Cross reference to related applications". Additionally, the status of 08-595,040 should be updated by inserting --, now U. S. Patent 6,090,312.-- after "08-595,040".
- d) The claims should commence on a separate sheet of paper: please see 37 CFR 1.52(3).

The following guidelines illustrate the preferred layout and content for patent applications. These guidelines are suggested for the Applicants' use.

Arrangement of the Specification

The following order or arrangement is preferred in framing the specification and, except for the reference to the drawings, each of the lettered items should appear in

upper case, without underling or bold type, as section headings. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) Title of the Invention.
- (b) Cross-Reference to Related Applications.
- (c) Statement Regarding Federally Sponsored Research or Development.
- (d) Reference to a "Sequence Listing," a table, or a computer program listing appendix submitted on compact disc (see 37 CFR 1.52(e)(5)).
- (e) Background of the Invention.
 - 1. Field of the Invention.
 - 2. Description of the Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (f) Brief Summary of the Invention.
- (g) Brief Description of the Several Views of the Drawing(s).
- (h) Detailed Description of the Invention.
- (i) Claim or Claims (commencing on a separate sheet).
- (j) Abstract of the Disclosure (commencing on a separate sheet).
- (k) Drawings.
- (l) Sequence Listing, if on paper (see 37 CFR 1.821-1.825).

Claim Objections

- a) Claims 3, 4, 11, 21, 23, 25, 30, 39, 41 and 44 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of independent claim 1 (from which all these claims ultimately depend on). Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Independent claim 1 is drawn to a reactor, whereas claims 3, 4, 11, 21, 23, 25, 30, 39, 41 and 44 are drawn to processes.
- b) Claims 7, 8, 12, 14-18, 20, 22, 24, 26-29, 32-38, 40, 42, 43 and 45 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of independent claim 5 (from which all of these claims ultimately

depend on). Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Independent claim 5 is drawn to a reactor, whereas claims 7, 8, 12, 14-18, 20, 22, 24, 26-29, 32-38, 40, 42, 43 and 45 are drawn to processes.

c) Claim 13, 19 and 31 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of independent claim 9.

Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In dependent claim 9 is drawn to a reactor, while claims 13, 19 and 31 are drawn to a process.

d) In claim 1 line 19, there is no antecedent basis in the previous claim language for "inner membrane tube".

e) At the end of claim 1 as well as in claims 3, 4, 5, 11-21, 24, 25, 28-34, 36-39 and 42-44, Markush language is required to list the various species recited therein: please see section 2173.05(h) in the MPEP (8th ed.) for information concerning the use of Markush-style groupings of species within the claims.

f) All of the dependent claims should be reviewed to ensure that there are no redundant limitations set forth therein that have already been recited in the claim from which they depend. *For example*, claim 11 sets forth that the final permeate stream contains pure hydrogen, permeated through the far outer membrane tube, but these limitations already appear in claim 1.

g) The recitation of features of the apparatus set forth in the process claims is objected to because it further limits the apparatus, rather than the claimed process. *For*

example, process claim 11 further limits the apparatus by setting forth the materials that the membrane is made of, but this is not a process step, per se. It is suggested to delete the details of the apparatus set forth in the elected process claims.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 3, 4, 7, 8 and 11-45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as their invention.

(Note that claims 1 and 5 have been included in this rejection (even though they have been withdrawn from further consideration as being drawn to a non-elected invention) since the elected dependent claims are still dependent thereon.)

a) Claim 1 (as well as claim 5) does not particularly point out and distinctly set forth what the difference is between the "non-permeate hydrogen" set forth in lns. 12-13 and the "hydrogen to be removed by permeation" mentioned in ln. 10. What is it about these two groups of hydrogen that would allow one to be pass through the membrane while the other is impermeable to the membrane? Did the Applicants intend to refer to "residual, unpermeated hydrogen" in lieu of "non-permeate hydrogen to be rejected by the membrane"?

- b) In claim 1 Ins. 25 et seq. the phrase "... with the main heating load of this inner catalytic zone achieved via heat transfer from tubes flowing gas ..." is vague and indefinite. How much is supplied via the vague limitation "main heating load"?
- c) In claim 1 Ins. 25-28 (as well as in claim 5), is the "main heat load" ("heat load" for claim 5) supplied by passing a hot combustion off-gas through the tubes within the inner catalytic reactor, or an exothermic reaction between the "waste-type hydrocarbons" and the oxygen occurring within these tubes in the vicinity of the inner catalytic reactor?
- d) In (at least) claim 1 In. 28 (as well as claim 5), "type" can not be used to further limit "hydrocarbons": please see the discussion of the *Ex parte Copenhagen*, 109 USPQ 118 decision set forth in section 2173.05[b](E) in the MPEP (8th ed.).
- e) Claims 1 and 5 do not particularly point out and distinctly set forth what the difference is between "waste-type hydrocarbons" and any other type of hydrocarbons.
- f) In claim 1 Ins. 31-32 (as well as in claims 3, 5, 7 and 8), the phrase "... various separation processes including ..." does not particularly point out and distinctly set forth the invention: please see section 2173.05[d] in the MPEP (8th ed.). "Various" renders the claims vague and indefinite.
- h) The term "lesser degree" in claims 3, 4 and 7 is a relative term which renders the claim indefinite. The term "lesser degree" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

i) All of the dependent claims should be reviewed to ensure that there are no limitations contained therein, which are contrary to the limitations set forth in the claims on which they depend. For example, claim 3 is not consistent with claim 1. *For example*, claim 3 recites that the inner tube is made by porous inorganic or inorganic-metal membrane material, whereas claim 1 recites that the membrane is made by a non-porous inorganic or carbon material. Claim 3 recites that carbon monoxide, carbon dioxide, steam, etc. permeate through the membrane, whereas claim 1 recites that the carbon monoxide, carbon dioxide, steam, etc. are rejected by the membrane. Claim 4 is rejected for the same reasons.

Note that claim 7 sets forth that next inner hollow cylinder is made by a porous inorganic or inorganic-metal membrane, while claim 5 sets forth that the next inner cylinder is made by a non-porous inorganic.

j) In claims 24 and 25, the phrase "for other CO₂ and H₂ direct combination reaction" does not particularly point out and distinctly set forth the invention. "Other" does not particularly point out and distinctly set forth the invention.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

The person "having ordinary skill in the art" has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The references of record in this application reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 3, 4, 7, 8 and 11-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over the article titled "Development of a Novel Oxidative Palladium Membrane Reactor" by Itoh et al. published in AIChE Symposium Series Vol. 85, No. 268, 10-17 in view of the article titled "Steam Reforming of Natural Gas with Integrated

Hydrogen Separation for Hydrogen Production" by Oertel et al. published in Chem. Eng. Tech. 10 (1987) 248-255.

The Itoh et al. article describes what appears to be at least an obvious variation of the same method and apparatus for simultaneously conducting an exothermic reaction (the oxidation of hydrogen with air to produce water) and an endothermic reaction (the dehydrogenation of 1-butene to butadiene) in adjacent reactors separated by what appears to be a single palladium membrane, which allows heat to be transferred from the exothermic reaction to the endothermic reaction and also allows the hydrogen by-product resulting from the dehydrogenation of the 1-butene into butadiene to be transferred from the endothermic, dehydrogenation reaction to the exothermic, hydrogen oxidation reaction. Please see the discussion provided in the paragraphs under "MODEL DEVELOPMENT" and also Fig. 1 in this Itoh et al. article for reference and further details.

The difference between the Applicants' claims and the Itoh et al. article is that:

*the Applicants' claims call for the presence of *two* membranes between the exothermic and endothermic reactors with the injection of sweep gas through the space provided between these two membranes, (evidently) so that *only pure hydrogen* passes through the second membrane into the other, hydrogen-consuming reactor: please see Applicants' claim 1, Ins. 17-18 and/or (evidently) the impure hydrogen product can be removed (i. e. swept) from the system and purified prior to any subsequent use (whereas Fig. 1 in the Itoh et al. reference illustrates the use of a *single* membrane between the exothermic and endothermic reactors so that (evidently) hydrogen *and*

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other reaction by-products and residual, unreacted reagents are transferred to the oxidation reactor),

*the Applicants' claims recite the use of a variety of hydrogen-consuming reactions, *other than* the air oxidation of hydrogen expressly mentioned in the Itoh et al. article (please see the last portion of the Applicants' independent claims).

The Oertel et al. article is directed to the same art of (evidently) conducting simultaneous hydrogen-producing reactions (the steam reformation of methane) and hydrogen-consuming reactions (the synthesis of methanol): *please compare to the "steam hydrocarbon reforming" limitation of (at least) Applicants' claim 1 and also to the "hydrogenation to methanol" limitation of (at least) Applicants' claim 5* in what appears to be a cylindrical tube reactor equipped with cylindrical sections and membranes for hydrogen separation (please see the paragraph titled "2 Model Concept" and also the paragraph at the bottom of the left column on pg. 250 in this Oertel et al. article). More specifically, Fig. 1 (b) illustrates the off-gas exiting the steam reformer as passing through means to separate off some water and some carbon dioxide out of the steam reformed off-gas before the steam reformed off-gas is injected into the methanol synthesis unit.

It would have been obvious to one of ordinary skill in the art at the time the invention was made *to modify* the process and apparatus discussed and illustrated in the Itoh et al. article *by providing* an additional, second membrane adjacent to the hydrogen-consuming reactor so as to provide a space between the membrane impinging the hydrogen-producing reactor and the membrane impinging the hydrogen-

consuming reactor, in the manner called for in the Applicants' claims, *because* the provision of this second membrane (along with the space between the two membranes) is submitted to be an obvious means for further purifying the off-gas exiting the hydrogen-producing reactor before it permeates into the hydrogen consuming reaction, and the space between the two membranes would allow for the contaminated hydrogen gas product to be swept out of the reactor, purified and then used in the hydrogen-consuming reactor as pure hydrogen, *in the manner fairly suggested by* the gas purification means (i. e. the water removal means and the carbon dioxide removal means) illustrated between the reformer unit and the methanol synthesis unit in Fig. 1 (b) in the Oertel et al. article so that only purified hydrogen gas enters the methanol synthesis unit.

The limitations set forth in the Applicants' claims reciting the various hydrogen-producing and various hydrogen-consuming reactions to be used in the two reactors are noted, but are submitted to have been obvious to one of ordinary skill in the art at the time the invention was made *to readily envision* the use of hydrogen-producing and hydrogen-consuming reactors set forth in the Itoh et al. and Oertel et al. references for any reactions that produce and consume hydrogen, *in addition to and other than* only those expressly mentioned in the Itoh et al. and Oertel et al. references.

The following references, which are indicative of the state of the art, are made of record:

U. S. Pat. 6,274,260 B1 disclosing a plant with high temperature fuel cells, wherein the heat required for the endothermic reaction can be transferred via radiation from the fuel cells to the reformer (please see the abstract);

U. S. Pat. 5,935,533 disclosing a membrane reactor hollow tube module with ceramic/metal interfacial zone;

U. S. Pat. 5,198,310 disclosing endothermic and exothermic reactions occurring within the same system (please see col. 3 lns. 19-53);

U. S. Pat. 4,423,022 disclosing a processes for carrying out exothermic and endothermic reactions, wherein means are provided for effecting "cross-over" material flows (please see the abstract), and

U. S. Pat. 3,950,447 disclosing a method for simultaneously carrying out reactions involving the evolution and consumption and hydrogen.

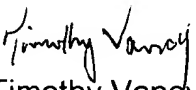
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy C. Vanoy whose telephone number is 703-308-2540. The examiner can normally be reached on 8 hr. days.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffen can be reached on 703-308-1164. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Timothy Vanoy/tv
January 24, 2002


Timothy Vandy
Patent Examiner

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